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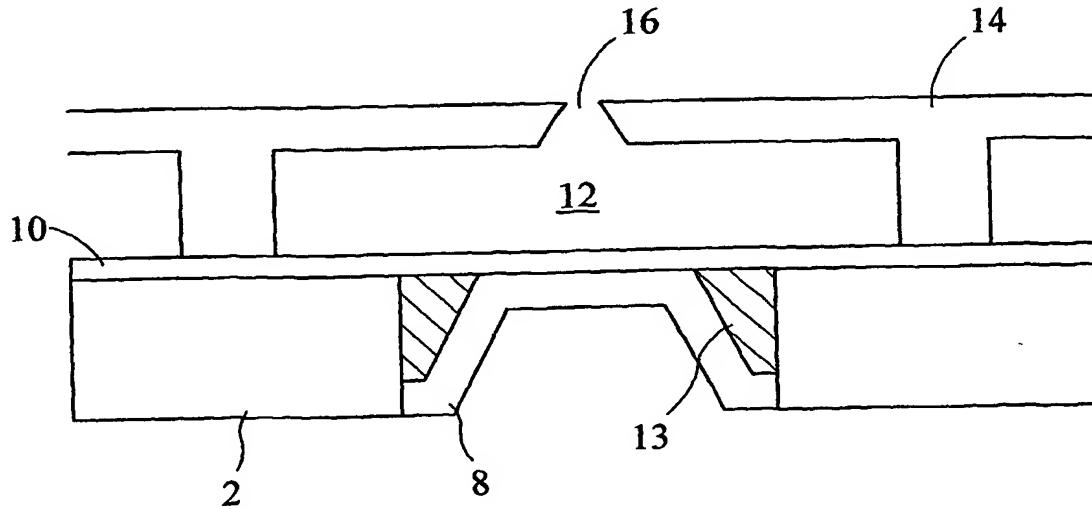
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(54) Title: DROPLET DEPOSITION APPARATUS



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(57) Abstract: A drop on demand ink jet printer, has a passive component (14) defining ink ejector chambers (12) with respective ejection nozzles (16); and an actuator component comprising a body (2) with an opening and an actuator structure (8) located within the opening. The actuator structure is formed of piezoelectric material by moulding from a slurry or vacuum forming of flexible sheets using formers that are burnt away. MEM's techniques may also be employed to build the structure on a silicon wafer using a succession of masked deposition; etch back and similar process steps.



- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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# INTERNATIONAL SEARCH REPORT

Int'l Application No  
PCT/GB 03/05626

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B41J2/14

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 B41J H01L B81B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, IBM-TDB

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/72520 A (SAKAMOTO YOSHIAKI ; FUJITSU LTD (JP); KOIKE SHUJI (JP); SHINGAI TOMOHI) 4 October 2001 (2001-10-04) the whole document & US 2003/016273 A1 (SAKAMOTO YOSHIAKI ET AL) 23 January 2003 (2003-01-23)	1-5, 10-19
X	WO 01/72519 A (SAKAMOTO YOSHIAKI ; FUJITSU LTD (JP); KOIKE SHUJI (JP); SHINGAI TOMOHI) 4 October 2001 (2001-10-04) the whole document & US 2003/025767 A1 (SAKAMOTO YOSHIAKI ET AL) 6 February 2003 (2003-02-06)	1-4, 10-19
X	TW 506 908 B (NANODYNAMICS INC) 21 October 2002 (2002-10-21) the whole document	1-3, 11 -/-

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

### Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority, claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

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Name and mailing address of the ISA

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## INTERNATIONAL SEARCH REPORT

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	& US 2003/025767 A1 (CHEN-HUA LIN) 6 February 2003 (2003-02-06)	
A	WO 00/16981 A (XAAR TECH LTD ;TEMPLE STEPHEN (GB); HARVEY ROBERT ALAN (GB)) 30 March 2000 (2000-03-30) cited in the application the whole document	
A	EP 0 921 003 A (OCE TECH BV) 9 June 1999 (1999-06-09) column 4 - column 7	6
X	WO 02/078959 A (PHILIP MORRIS PROD) 10 October 2002 (2002-10-10) paragraph '0023! - paragraph '0042!	20-28
X	US 6 428 140 B1 (CRUZ-URIIBE ANTONIO S) 6 August 2002 (2002-08-06) column 3 - column 9	20,21,28
X	US 5 459 501 A (LEE STEVEN S ET AL) 17 October 1995 (1995-10-17) column 4, line 58 - column 5, line 33	29-40, 43,44
X	US 2002/130925 A1 (KOEDA HIROSHI) 19 September 2002 (2002-09-19)  paragraph '0034! - paragraph '0056!	29-31, 36,37, 41,42

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB 03/05626

### Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.: 72,73 because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
3.  Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

### Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  

1-44

  
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

#### Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International Application No. PCT/ GB 03/05626

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 72,73

Claims 72 and 73 are omnibus claims: these claims do not define any subject matter than by reference to the figures. These claims do not meet the requirements of Art. 6 and Rule 6.2(a) PCT. No search can be performed.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

## INTERNATIONAL SEARCH REPORT

International Application No. PCT/ GB 03/ 05626

### FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

#### 1. claims: 1-19

Actuator components as explained in points 1.1 and 1.2 below.

##### 1.1. claims: 1-11,16-19

Actuator component as defined in claim 1, in particular directed to an actuator as defined in claim 1,5,6.

##### 1.2. claims: 1,11,12-15,18,19

Actuator component as defined in claim 1, in particular directed to an actuator as defined in claim 1,11,12

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#### 2. claims: 20-28

A component for ejecting a droplet in a direction of droplet flight, said component comprising an actuator structure displaceable by actuation in the direction of said droplet flight (cf. part of claim 20): in particular directed to said actuator (19,20) defining in part an ejection chamber and comprising a port through which said droplet is ejected.

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#### 3. claims: 29-44

The method of claim 29 in particular directed to: a) providing a body having a mould feature, b) forming a deformable actuator structure, the shape of said actuator structure being defined, at least in part by said mould feature, c) removing at least a portion of said mould feature.

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#### 4. claims: 45-62

The method of claim 45 in particular directed to the additional steps of b) forming an opening in said top surface and extending into said body and; c) forming within said opening an actuator structure; said actuator structure remaining attached to said body during actuation.

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#### 5. claims: 63-71

## INTERNATIONAL SEARCH REPORT

International Application No. PCT/ GB 03/05626

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

The channeled component of claim 63 in particular directed to a respective ejection nozzle connected with the channel at a point intermediate its length; a liquid supply providing for continuous flow of liquid along said channel; acoustic boundaries at respective opposite ends of the channel serving to reflect acoustic waves in the liquid of the channel wherein the inter-channel spacing of said acoustic boundaries is different to the inter-channel spacing of said nozzles.

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

PCT, GB 03/05626

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